UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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Fact Sheet

Columbia/Snake River Problem Assessment for Temperature

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Introduction

A problem assessment for water temperature in the Columbia and Snake Rivers was developed in support of a Total Maximum Daily Load (TMDL) for temperature. The TMDL is being developed by EPA, Idaho, Oregon and Washington in coordination with the Columbia Basin Tribes. A Total Maximum Daily Load (TMDL) is required by the Clean Water Act for water bodies that do not achieve water quality standards. A TMDL establishes the amount or load of pollutant that a stream can receive and still achieve water quality standards. The problem assessment was developed to evaluate existing water quality against the water quality standards, and to evaluate the causes of temperature impairment in the rivers. The problem assessment provides information on the amount of improvement needed and the sources of temperature that need to be reduced. The TMDL will quantify the allowable thermal load to the river necessary to achieve that improvement and allocate thermal load among the various sources.

Basis for the Problem Assessment

This temperature assessment relies on existing temperature data from the river and mathematical modeling of the temperature of the river. Both the temperature observations from the rivers and the temperature simulations of the rivers provide estimates of water temperature. There are data and information gaps and uncertainties associated with both the observations and the simulations so we use them both to gain an understanding of the temperature regime of the river and the relative importance of dams, point sources and tributaries in altering the natural regime of the rivers.

Findings

The water temperature in the Columbia and Snake rivers frequently exceeds state and tribal water quality criteria for temperature during the summer months all along their lengths within the area of the TMDL.

The water temperatures of the rivers before construction of the dams could get quite warm, at times probably exceeding even the 20 °C temperature criteria of Oregon and Washington on the lower Columbia River.

However, these warm excursions were much less frequent without the dams in place. Both temperature observations and modeling simulations show that the frequency of exceedance at Bonneville Dam of 20 °C increased from about 3% in the absence of dams to 13% or greater with the dams in place.

The dams appear to be the major cause of warming of the temperature regimes of the rivers. Model simulations using the existing temperatures of tributaries and holding tributary temperatures to 16 °C revealed little difference in the frequency of excursion of 20 °C.

Global warming or climate change may play a small role in warming the temperature regime of the Columbia River to date. The Frazer River, with no dams, shows an increasing trend in average summer time temperature of 0.012 °C/year since 1941, 0.022 °C/year since 1953. The average summer time temperature at Bonneville Dam on the Columbia River increased from 18.8 °C before all the dams were constructed to 20.5 °C after all the dams were constructed.

The free flowing river average water temperatures fluctuated diurnally more than the existing average temperatures so while they would get quite warm in the day they would be cooler at night.

The free flowing river average water temperature fluctuated in response to meteorology more than the impounded river. Cooling weather patterns tended to cool the free flowing river but have little effect on the average temperature of the impounded river.

The free flowing river water temperatures cooled more quickly in the

late summer and fall.

Alluvial flood plains scattered along the rivers moderated water temperatures, at least locally, and provided cool water refugia along the length of the rivers.

The existing river can experience temperature gradients in the reservoirs in which the shallow waters are warmer.

Fish ladders, which provide the only route of passage for adult salmon around the dams, can become warmer than the surrounding river water.

For more information

Columbia/Snake Rivers TMDL Web Page:
www.epa.gov/r10earth/columbiamainstemtmdl.htm.

This web page contains the following documents:

Draft Problem Assessment for the Columbia/Snake River Temperature TMDL;

Application of a 1-D Heat Budget Model to the Columbia River System;

Columbia and Snake River Mainstem TMDL Fact Sheet;

RBM-10 Water Temperature Model Fact Sheet;

Workplan, Communication Strategy and Schedule for the Columbia and Snake River TMDL;

Columbia and Snake River TMDL Workshop Presentations and Results